THIRTY-FIFTH ANNUAL REPORT

FOR THE CALENDAR YEAR 1945

– Northern –
Rocky Mountain
Forest & Range
Experiment Station
Missoula, Montana

M. Bradner, Director

NOT FOR PUBLICATION

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

ADDRESS REPLY TO
DIRECTOR
AND REFER TO

FEDERAL BUILDING
MISSOULA, MONTANA

R-NRM
REPORTS
Station's Annual (1945)

January 28, 1947

Dear Sir:

It is with great satisfaction that I transmit to you the thirty-fifth Annual Report of the Northern Rocky Mountain Forest and Range Experiment Station (for the calendar year 1945). Written in early 1946, its publication and distribution were delayed by the untimely passing of Director Melvin Bradner.

Recounting the work and reflecting the handicaps of forest and range research workers during a year in which the greatest of all national efforts resulted in victory for the allied forces, this report will be an interesting and valuable edition in the long series of Northern Rocky Mountain Station releases.

The forward-looking hopeful tenor, the keen discernment of vital problems, and the sound program which characterize this report make of it a fitting and lasting tribute to a true forester. We shall miss Melvin Bradner and his works.

Very truly yours,

Chas. L. Tebbe

CHAS. L. TEBBE
Director

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FOREWARD

During the past year, and especially since V-J Day, the newspapers, national magazines, and even the Congressional Record have published the word RESEARCH more frequently and in relation to a greater variety of human and industrial events than ever before. Every man on the street now knows that the atomic bomb was, first of all, the brainchild of scientific research. Every industrialist knows that new products developed by research are more likely than ever before to affect his business. Here in our own region the Spokane Chamber of Commerce is planning a "Wood Products Clinic" to help accelerate this trend. Meanwhile many national magazines are carrying full-page advertisements of the great research laboratories to be built by private industry at tremendous cost to further improve their products. The word "research" is becoming synonymous with progress in the practical affairs of all of us.

Without doubt one of the greatest causes of this new interest was the report "Science, the Endless Frontier", prepared under the direction of Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, and one of the few men directly concerned with all phases of the production of the atomic bomb. This report has been widely publicized by magazines such as Engineering News Record, Business Week, Science, Time, Fortune, Look, and others. At least three bills have been introduced in Congress implementing the proposals of the Bush report to expand nearly all types of scientific research. Committees consisting of the most eminent men and women in American science are actively supporting this new and biggest organized effort to expand research work.

Two features of this are going to affect future research by our experiment station. First, this new interest and even reliance on research should cause both the public and Congress to examine our programs and the finances essential to an adequate program. We should, therefore, expect much more support and much less apathy toward our work. Second, we can now benefit, if we choose to in devising our research program, from the advice and recommendations of the Bush Report based on national viewpoints of America's outstanding scientists. Two of these recommendations apply specifically to scientific research in the Government Service.

The first of these recommendations concerns the place of Governmental research in the national plan, and the fields to which our research should be limited. This is stated as follows: "Research carried on directly by the Federal Government represents an important part of our total research activity and needs to be strengthened and expanded after the war. Expansion, however, should be limited to fields of inquiry and service which are of public importance and are not adequately carried on by private enterprise."

The second recommendation pertains to a condition altogether too well known to all men engaged in the necessarily long-time projects required in growing trees or protecting timber and watersheds for 100 years. This condition, however, has clearly not been well understood or appreciated by people who have never attempted to pursue continuity of work under annually changeable appropriations of funds. The Bush report describes this condition and recommends a remedy as follows: "Current budgetary procedure of Government provides funds on an annual basis, yet only a small percentage of the research conducted by Government agencies can be planned adequately or appraised satisfactorily on a one-year basis. Research programs should somehow be assured in terms of their long-run objectives. If approved, funds should be guaranteed over the period of years necessary to permit continuity of effort and attainment of these ultimate objectives."

Reports of our research which follow, by Divisional lines of work, should be scrutinized in the light of these two eminently sound recommendations.

GENERAL

This report is distributed to all cooperating and interested forest agencies and individuals in the Northern Rocky Mountain region for one specific purpose: To inform them briefly of the major accomplishments and plans of our Experiment Station. It is only by exchange of such information that numerous agencies all working in one field of endeavor can hope to direct and coordinate their work toward most efficient regional progress.

The need for such exchange and resultant better coordination has been stressed at three recent meetings in the Northwest. It was the major theme of the Western Forestry and Conservation meeting at Portland, Oregon, December 13-15, 1945. It was the outstanding recommendation of Dr. Wilson Compton at the December 27, 1945 meeting of the Northwest Scientific Association at Spokane. Dr. Compton particularly urged the research men of the various educational institutions of the entire Northwest to be "less scrupulous about state lines in exchange of research results." Similarly at the Moscow, Idaho meeting of the Inland Empire Section of the Society of American Foresters on January 26, the major purpose was to permit all interested agencies to make inquiries and suggestions concerning the present status and future plans of blister rust control.

The war unavoidably interrupted some of the previous procedures of exchange of research information. That interruption in turn has resulted in a "back-log" of information and experience by each research agency which requires early channeling to all other agencies. Resumption of suspended publications can do much to distribute results obtained, but such publications, even though they are annual reports of both accomplishments and plans, are not sufficient. Even such annual reports do not draw out the type of critical and productive discussion that occurs in a personal meeting of well-informed research men.

To aid the many forest research agencies of this region in better exchange of information, hence avoidance of duplication, the Northern Rocky Mountain Forest & Range Experiment Station will revive the Forest Research Council meetings formerly called annually.

RANGE RESEARCH

Reconversion: Reconversion to peace is the problem of the hour in all fields. Industrial and business reconversion take the spotlight because we as a nation have been taught by constant publicity and propaganda to pay deference to these activities. Important and essential as these activities are, there is grave danger that the basic natural resources which were such a vital element in victory will be further overshadowed and neglected. Our unsurpassed natural resources with which we were fortunately endowed without forethought on our part and which have been rather consistently exploited, do not yet receive fair credit for a vital contribution to our present position of world leadership. To be sure, the spectacular exploits of science--radar, loran, atomic fission, etc.--properly have been lauded for their contributions to victory. But there is still inadequate recognition that these accomplishments can only be built and sustained on a foundation of rich natural resources. The unspectacular fields of science that point the way toward conservation and wise use of basic resources appear to be in danger of further eclipse in the public mind. One very important national problem is, how to get the public support and emphasis needed to perpetuate, rebuild, and safeguard these wasting resources without which no nation can exert much influence hereafter. Range is one that has been exploited.

Reconversion of the range research program started with the return from military service of Friedrich in October and Merrick in December to the range reseeding project. Project plans are being correspondingly intensified. Some of the other changes have been made or started. With relaxation of auto travel restrictions after V-J day, a part of the field work on a problem analysis of Northern Great Plains ranges was done in late August and September. Another step in early reconversion of the Division will be possible when work can be resumed on summer ranges after the return of Grant Harris and Anthony Evanko from the Pacific theater.

Basin Developments: The urge for sound range management practices is now greater than ever before because of the advanced stage of construction plans for this program. The end of the war also set the green light for a great 1½ billion dollar program of water developments in the Missouri River Basin and a corresponding plan for the Columbia. Even the meager generalized knowledge as to the relationship between the vegetal cover and its use on the one hand, and its influence on water yield, usability, erosion, and siltation on the other, emphasizes the need for intensified range research in the basin. Such work can be even more effective and valuable for guiding the pending developments when a well staffed Division of Forest and Range Influences is established to study and correlate more closely the relationships. The urgent need for basic facts in these gigantic basin development plans has been seriously obscured by the controversy as to how and who should do the job. Meantime, plans are shaping very rapidly. It seems evident that serious errors may be made in a program which is to extend over two decades unless pertinent facts regarding range, forest, and watershed management are dug out without delay. The need is especially urgent on mountain ranges because of the high water yield but is also of great importance on the plains because of the tremendous acreage of these ranges.

Wheat and Range: Ranch and range operators also have reconversion problems, some of which are not fully defined because of wartime controls, markets, and the unusually favorable weather of recent years. Some ranchers realize that many ranges are heavily stocked. It is also the considered opinion of qualified students that a reduction up to 10 million acres in wheat from recent levels may be needed in the next few years. The bulk of this curtailment may fall to the great plains country where grass is one of the few alternative crops suitable for this semiarid region. This indicates an increased need for better information as to the best species and cheapest methods for artificial reseeding as the less productive dry lands are retired from crops. Fortunately, reseeding research during the past decade has provided some basis for meeting this need. However, there is need for more intensive research in this field to cheapen methods, test species, and mixtures that will be best for converting these crop lands to their highest use under more normal world conditions. The fact that cattle numbers are still close to an all-time high and that drought may reoccur is an added reason for pressing reseeding research as aggressively as possible. Thus, there is urgent need for a sound factual basis in both the short time as well as long time developments in range and watershed management.

Accomplishments During 1945

Management Summer Ranges:

All field work was discontinued at the Vigilante branch station in the fall of 1944 after Grant Harris was inducted into the Navy. However, a summary and analysis was made during the winter of 1944-45 of data previously collected. Some conclusions reached or reaffirmed are briefly listed below:

Plant Development: Records over the period 1938-44, inclusive, indicated that grazing on lower Ruby River range may be safely started by about May 21 on the average as compared to the present June 1 opening season. The earlier date is based on the time when 75 percent or more of the Festuca idahoensis and Poa sequnda are in the "boot" stage. The boot stage of Agropyron spicatum is later. However, basing the opening date on the boot stage is not entirely satisfactory because of the great variation in the percentage of plants of these three species that do not produce boots or culm stalks even in favorable years. For instance, the variation was from 6 to 75 percent for Poa, 1 to 93 percent for Festuca, and 1 to 78 percent in the case of Agropyron on protected ranges during favorable years 1938 to 1944. Because of this variation, the relationship between the boot and height stages was established from our records. This made it possible to define an opening date based on average maximum height of basal leaves. This is more specific and more easily determined than the "boot" criterion. On the average, Festuca, Poa, and Agropyron made 80, 90, and 60 percent of maximum basal leaf growth by May 20, equivalent in leaf growth to about 4, 2, and 4½ inches, respectively, on this site. During these favorable years the trend in vigor was upward as shown by increased height growth of these grasses. Also, intensive close clipping studies of these grasses beginning at the early boot stage caused no more decline in vigor than clipping

3 weeks later. These results all support the conclusion that an earlier opening date than June 1 may be safely established for this range up to about the 6,800-foot level.

Incidentally, the percentage of plants producing culms was closely proportional to rainfall of the previous September during the 1938-43 period. Contrary to the usual view, current spring precipitation during this period appeared to have slight influence on maximum leaf height or culm production. Agropyron spicatum proved to be very sensitive to close clipping three times during the season starting in May, while Festuca and Poa held up much better under such treatment. In the second year, production of Agropyron dropped by about 50 percent under clipping to a 2-centimeter stubble. This indicates what may happen with one year of overgrazing. Also, it helps to explain the almost complete absence of this species from many ranges where it was once conspicuous. These studies, now dormant, when strengthened by additional data would provide the basis for defining the ecological stage that should be aimed for in managing such summer ranges.

Management Short-Grass (Mixed Prairie) Ranges:

The 60 experimental cows (mainly 10-year-olds) were sold in November after eight years on heavily, moderately, and lightly stocked range pastures at the U.S. Range Livestock Experiment Station. Sale data provide the information for a final appraisal of the effects of varied stocking on beef production as shown by weights of eight crops of calves and the salvage value of these cows at the end of their breeding usefulness. Weather conditions and forage growth have been rather consistently favorable during the years 1938 to 1945, inclusive. Differences in production were important but doubtless less marked than would have been the case with a more normal weather sequence.

Beef Production: Seasonal weight trends for both cows and calves were similar to those of past favorable years. Cattle were moved to fresh summer pastures on May 15. By October 30, cows on heavily stocked ranges were lighter than in mid-May, but those on moderately and lightly stocked pastures weighed about 65 pounds heavier than in the spring. This extra weight means a material saving in the amount of feed and cost of wintering. Maximum cow weights were recorded early in August for all lots, but all declined considerably thereafter. From the standpoint of maximum cow weight, the advantage of marketing at this late summer stage rather than in October or November, as is often done, was again demonstrated.

All the cows (38 originals and 22 replacements) were sold through the Miles City sales ring on November 14, about 2 weeks after calves were weaned.

Table 1.--Relative weight and salvage values, old cows.

Stocking rate	Average weight (pounds) 1/	Price per hundredweight	Salvage value per cow
Heavy 2/	964.7	$7.90	$76.21
Conservative 3/	1063.4	8.36	88.90
Advantage	98.7	$0.46	$12.69

1/ Weights are for October 30, 1945 when calves were weaned and cows removed to winter pastures to dry up and settle down.
2/ 23.1 acres per cow yearlong.
3/ Includes moderate, 30.5 and light, 38.8 acres per cow yearlong.

Prorating the $12.69 over the 8-year period, the advantage amounts to $1.59 per cow year.

In 1945 weaning calves for the heavily stocked ranges averaged 374 pounds as compared to 400 pounds for those conservatively stocked ranges. All heifers averaged 377 pounds as compared to 402 pounds for all steers.

While calves from heavily stocked pastures were approximately equal in weight during two exceptionally good forage seasons previously, they averaged substantially lighter over the 12-year period, including four calf crops from a previous group of experimental cows.

Table 2.--Relative calf production, 12-year average.

Stocking rate	Percent calf crop (%)	Average weaning weight per calf (pounds)	Calf weight production per cow (pounds)
Heavy	79	354	279
Conservative	85	382	324
Advantage	6	28	45 at 10¢ = $4.50 per cow

The advantage of $4.50 greater calf production per cow plus $1.59 greater salvage value per cow amounts to $6.09 per cow annually.

Conservative stocking also resulted in a net saving in total feed costs, range plus supplements. The rental cost of extra range acres (at 10 cents per acre) was more than overbalanced by the saving in supplemental feed (hay at $8 per ton) required during winters and two drought years, 1934 and 1936, as shown in the following comparison:

Average feed cost, heavy stocked range	$8.39 per cow year
Average feed cost, conservatively stocked range	6.91 " " "
Advantage	$1.48

This $1.48 advantage added to $5.89 gives a total dividend of $7.37 per cow year for conservative over heavy stocking even without considering reduced risk and higher market quality of calves. It is thus obvious that heavy stocking results in very heavy penalties even before considering how it may undermine permanent welfare of the range itself.

Cattle Habits and Salt Consumption: Cattle habits were affected by heavy stocking rate. Cows grazed faster than on the conservatively stocked range and spent almost an hour more per day in this activity. Despite the extra effort, the scanty feed obtained left the cows nearly 100 pounds lighter at the end of the summer period. Aside from the differences due to stocking, the topography, subtypes, and composition all exerted some influence on grazing habits of the cows.

During the past six summer seasons with somewhat better than normal growing conditions, the experimental cows on this range used an average of 1.3 pounds per month of a 3 to 1 salt-bonemeal mixture and 1.0 pound per month during five of the past winter periods, or a total of 15.3 pounds per cow year. Natural salts (alkali) are rather common on this range and it is the practice of some operators not to provide salt on the theory that there is enough in the forage and water for cattle requirements.

It was also noteworthy that salt consumption was lower, 0.75 pound per cow month, during the May to August period of green feed over a 5-year period than during the period of dry feed, September through April of one year, 1944-45, when consumption was 1.8 pounds per cow month. This is contrary to a prevailing belief that salt requirements are higher during the period of green growth.

Vegetal Trends: After six years of favorable weather, the total cover of range vegetation by 1944 was, based on quadrat records, back to the predrought level of 0.3 density. Growing conditions were also favorable last year, but total density as determined by quadrats had changed very little by early 1945. This indicates that the present cover is, after a long period of slow recovery, back in balance with favorable weather such as prevailed in 1933 and during recent seasons since the great drought.

Incidentally, the favorable seasons, coupled of course with prevailing high prices, are largely responsible for the record aggregate resources of $320,000,000 for 111 banks of Montana reported for December 31, 1945. This is at the rate of approximately $1,000 for every man, woman and child in Montana, virtually all from our soil. Also, these record figures are seven times greater than at the end of 1933 and three times more than at the end of 1940. These differences are due partly to drought and emphasize the tremendous importance of management practices that provide best possible safeguards against feast and famine extremes in production from range lands.

Composition of the range cover in 1945 was notably different than in 1935. Bluestem wheatgrass and blue grama were still 36 and 15 percent less than in 1935, while needleandthread grass, niggerwool, and buffalograss occupied 15, 34, and 49 percent more area, respectively, than just before the drought struck. Incidentally, these variations indicate clearly that weather must be taken into account and that vegetal specifications may not be too narrow in defining the ecological stages aimed at by management.

Utilization: A height-volume method of estimating utilization, based on an adequate sampling of stubble heights and percentages of plants grazed as previously developed, was further tested last year. This method has clearly revealed during the past seven years specific and material differences in the relative utilization of pastures stocked at 23.1, 30.5, and 38.6 acres per cow year. The cover on pastures stocked at the more conservative rate is highly vigorous and productive, while its condition on the heavily stocked pastures has declined. Utilization records for the moderately stocked pastures thus provide a tentative standard for use on these northern short-grass (or mixed prairie) ranges. Studies show a consistent and fairly close relation between utilization of key species and percentages of plants grazed without including the stubble height factor. This is because cattle tend to graze a given species to an approximate common stubble height at least until stocking is at such a heavy rate that starvation is threatened. It follows that for all practical purposes, utilization on these ranges can be satisfactorily estimated by the relatively simple procedure of determining percentages of grazed plants. However, where critical detailed comparisons are desired, more accurate determinations of utilization can be had by following the method briefly outlined above, using both stubble heights and percentages of plants grazed.

Heavy utilization over a period of 12 years as represented on pastures stocked at the 23.1-acre rate has resulted in a definite though not spectacular decline in height and density of blue grama, bluestem wheatgrass, and needleandthread grass as compared to the more conservatively stocked pastures. The size of clumps of grama, Sandberg bluegrass and needleandthread grass averaged smaller on the heavily grazed subtypes. Also, annuals of low value were more abundant while perennial forbs were less so on heavily grazed areas.

The comparative study made in 1945 from which the above differences are taken has not been completely analyzed. These data promise to yield further criteria as to the early stages of range deterioration so difficult to identify but so essential to skilful management.

Pricklypear cactus, which increased rapidly from 1936 through 1940, has since declined in amount and condition on plots of pastures compared, but the decrease has been more rapid on the conservatively stocked than on heavily stocked pastures. In 1945 the latter still had 11 percent more "joints" per acre than in 1936 when the plots were established, compared to 9 percent fewer "joints" on the conservatively stocked pastures. The amount of cactus on the variously stocked pastures appears to be inversely related with the density and vigor of the competing vegetation, which has been briefly described in the preceding paragraph.

Differences in production and vigor of vegetation due to heavy stocking by cattle over a 18-year period are evident but not striking or spectacular for these short-grass ranges. However, heavy grazing by sheep did cause very striking range deterioration in the 1936-42 period as compared to conservatively stocked range. Unusually favorable weather prevailed on both these ranges after early 1937. We can only surmise how the vegetation might have reacted under more normal weather--some dry or drought years interspersed between the favorable seasons from 1938 to 1945. Three questions of importance are posed by results to date:

1. Why did heavy stocking by sheep cause a sharp difference in a few years and heavy stocking by cattle over a longer period cause only a limited difference in trend and condition of range forage as compared to conservative stocking?

2. Under more normal sequence of weather, would the heavily and conservatively stocked cattle pastures have recovered at approximately the same rate from the 1934-36 drought years, and would the differences between heavily and conservatively stocked areas have been so limited as is now actually true?

3. Will this range stand up under continued stocking at the rate of 30.5 acres per breeding cow with a normal sequence of weather?

Economic aspects of the problem--the short time aspect at least--have been clearly answered by the fact that beef production (calf plus salvage cows) was approximately $6.00 per cow unit greater and feed costs $1.80 per cow unit less. This is a very satisfactory demonstration of the current advantage of conservative stocking. If, however, the heavily stocked range is just beginning to slip, the disadvantages can hardly fail to be increasingly serious. The question as to the cumulative effects of heavy stocking deserves further consideration from both the ecological and economic angles.

Also the important question of time and treatment required for recovery of such overgrazed short-grass range is not yet answered. Differences in condition between the heavily and more conservatively stocked pastures are not yet sufficiently striking to provide a wholly satisfactory basis for future study of rate of recovery under suitable management. What to do in these premises is a question of importance for consideration in plans for the future. They, as well as other range problems, will be weighed in the problem analysis for the Plains.

Management of Crested Wheatgrass:

The 46½-acre crested wheatgrass pasture at the U.S. Range Livestock Experiment Station was grazed in 1945 for the seventh season by a group of yearling steers. Weight gains averaged 1.92 pounds daily for the period April 4 to July 25 and 2.43 pounds per day for the 84-day period beginning May 2. Such gains are seldom exceeded on a full feed of grain and concentrates. They indicate the value of crested wheatgrass during the period of high palatability. Gains were at a very low rate through late July until the yearlings were removed from the area August 22 at an average weight of 721.3 pounds.

Somewhat similar weight trends have been recorded for this area during the past seven seasons. Utilization was heavy in 1945 and in two previous years. Even though there may be some declining trend in forage production due to heavy grazing and a gradual increase in density, total weight gains have been two to three times greater per acre than on adjacent native range. Herein is one strong reason why about 1½ million acres of Montana range has been reseeded in the past seven years.

A test has been initiated to determine whether renovation by two methods will retard the tendency of old stands to become sodbound and to decline in height growth and usable forage growth. Results are not yet available.

Preliminary tests made as to relative palatability for sheep of about 25 reseeded species at Judith Basin showed Bromus erectus and Festuca ovina, two of the very promising species, being grazed with apparent relish. Several of the other new promising species were grazed readily.

Artificial Range Reseeding:

Progress in artificial reseeding research was retarded by frequent changes in personnel. Friedrich, Drew, Morris, Hulbert and then Friedrich again were successively in charge with Merrick, Egeland and Wood assisting for short periods. We suffered another setback when our leased experimental area at Rock Springs in eastern Montana was sold and plowed under by the new owner. We had been working on this area for five years so that considerable data were plowed under. Despite these difficulties, some progress was made in certain aspects of the reseeding program.

Species Adaptation: During the fall new adaptation plantings were made for 29 grasses and 8 legumes. It was the first planting in the region for some of these. Plantings were made on formerly forested soils in the Bitterroot Valley and at Thompson Falls. Installations were also made on range soils at Judith Basin and in the Bitterroot Valley. Plans were made for tests in northeastern Montana.

a territory with special reseeding problems where we have made no previous tests. We were unable to establish adaptation and methods studies there before winter set in, however, because of repeated delays in getting clearance from the Soil Conservation Service for use of the selected area.

Most of the 40 species planted at the Vigilante High Altitude Nursery at 9,300 feet have survived since 1941. Bromus erectus, slender wheat, crested wheat, smooth and Parkland brome, meadow fescue, and sheep fescue are all doing very well there. A few others are making a fair to good showing. Detailed comparisons in 1946 will provide guidance as to species adapted to high altitudes. No new plantings were made at Vigilante or Miles City

Besides crested wheatgrass, several other species have shown real promise in numerous adaptation plantings, especially in hand seeded rows where generous rates of seeding were used on plowed seedbeds. Among the best of these are: Agropyron intermedium, Bromus erectus, Elymus junceus, Festuca ovina, and Arrhenatherum elatius. Though these five species appear to be quite widely adapted when once established, we have had difficulty in consistently obtaining good stands for some in range plantings on weedy or poorly prepared seedbeds. The need for more detailed studies of methods of planting these species is indicated. All of these are already represented in various mixtures, along with Ladak alfalfa and a few other species where more data on yields, persistence, etc. are needed. Preliminary observations indicate that several of these mixtures may yield well and lengthen the period of green forage. More definite results should be available when data now or soon to be available are fully analyzed. Incidentally, there is a keen demand for seed of several of these promising species from ranchers who are closely following our results. Unfortunately, the supply of seed is inadequate. A careful analysis is being made as a basis for recommending those for which commercial seed production may be warranted.

Methods: One of the most important reseeding problems in Montana is the rehabilitation of the many thousands of acres of formerly plowed range land that are now dominated by cheatgrass, mainly Bromus tectorum. The preparatory crop method of reseeding cheatgrass infested land has given some promise for increasing forage production several fold on such land at very low cost. A good deal of work will be needed yet to develop the possibilities and limitations involved. Mowing the preparatory crop for hay early in the season gives better control of cheatgrass than harvesting the crop later for grain. In one comparison there were 2½ times as many cheatgrass seedlings in the grain stubble as in the hay stubble at grass seeding time in the fall. Results from three years' tests indicate that a rancher may plow either late in the fall or early in the spring and successfully use several of the adapted small grains for a preparatory crop. Compana barley, a new variety recommended by the Montana Station, has given good grain yields the past two years and appears to make a good grade of grain hay

when mowed at the proper stage even though it is bearded. Winter rye, however, especially when harvested for grain, may produce volunteer stands that compete severely with the grass seedlings. Several ranchers are now using the preparatory crop successfully for reseeding their cheatgrass lands. Good results obtained by seeding in grain stubbles indicate the advisability of prompt reseeding of any land that may be dropped from crop production in the future.

The 825-acre airplane seeding in November 1944 on the Hanny Creek burn on the Cabinet National Forest showed very good results last fall. A satisfactory stand was established on more than 80 percent of the seeded area. Orchardgrass, timothy, Kentucky bluegrass, and bulbous bluegrass made a very good showing. Crested wheatgrass was less successful and sweetclover scarce. The stand of reseeded species provided good forage production and erosion control. This seeding area was mainly on a formerly timbered north slope. A small test on a cheatgrass-little bluegrass covered south slope burned at the same time was unsuccessful.

Encouraged by these results, a 500-acre burn on O'Keefe Creek near Missoula was seeded by airplane in October 1945 as a cooperative project by the Lolo National Forest with our help and guidance. The cost for seed and flying service was $1.20 per acre.

In the Bitterroot and elsewhere in western Montana, there is a strong urge to increase forage production on burned and cutover timbered lands. Species adaptation and methods of planting studies have accordingly been installed on such lands on three of the ranger districts in the Bitterroot Valley. Seeding on fresh skid trails and recent burns has provided an urgently needed increase in forage production and has checked erosion. A bulldozer and road ripper were tested for preparing seedbeds on stump land last fall. Several species and mixtures were seeded there.

Arrangements have been made with several progressive ranchers whereby we furnish technical advice and sometimes small amounts of seed for certain species planted in 1- to 10-acre plots on various soils using different types of seedbeds and planting methods. Some of these will be available for cafeteria style grazing trials and all will provide other information of value. Stanley Antrim has, for instance, planted 13 species with our help and seed under such an arrangement on his fall and winter range after it was cropped one year.

Plans for 1946

Management Summer Ranges:

When Harris returns this spring, research work will be resumed at the Pigeonte branch station. As soon thereafter as extensive

improvements and facilities can be installed there, it is planned to start a study to determine the effects on the cattle and on the range of stocking at three rates on these mountain ranges. It would be especially desirable if this could be correlated with a study to show influence of such use on runoff, erosion, and infiltration for such ranges. Evanko is expected back from the Philippines perhaps by July. He can be very helpful in getting a good program for summer ranges revived.

In the meantime the tentative utilization standard already worked out for mountain cattle range will be strengthened and tested with particular reference to slope, soils, etc. A substantial amount of basic data is now available from quadrats, clipping plots, utilization surveys, plant development records, and protected areas. When supplemented by some additional information on trends and condition, it should be possible to define in relatively definite terms what ecological stage should be aimed for in management.

Funds available or in prospect will carry this plan this fiscal year. However, an increase will be needed after July 1 to carry Evanko and to provide temporary help and other facilities needed for fully effective work. A substantial increase is needed for a well rounded research program on summer ranges.

Management Short-grass Ranges:

A qualified man to replace Woolfolk is needed to help in final analysis of project data now available. He should also participate in the final phases of the problem analysis of the Northern Great Plains and in planning new work based thereon.

Production studies on pastures stocked at three rates over the past 12 years is to take high priority in field work the coming season. Pastures will not be grazed next summer until after these comparisons are made. A roundup of other vegetal studies and records will be made this year to close the project.

The final roundup of data from proposed production and other studies should clear the deck for one or more major publications giving results for both range and livestock phases. A portion of the field work for a problem analysis was done late last season. It was interrupted by necessity to devoting time to fall reseeding jobs when a temporary man in charge needed help. This job will be taken up again, completed and written up as soon as possible this year. A decision should be reached as soon thereafter as possible as to a new project to be started for the short-grass or mixed prairie ranges. Reasons why maintaining varied stocking on pastures so used over the past 12 years until cumulative effects on cattle, vegetation, and soil are more clearly defined, are mentioned in a previous section. This

will, of course, have to be judged along with other projects to be covered in the problem analysis.

The various jobs concerned with closing of this project and with selecting and planning a new one are of unusual importance. This program will be retarded unless a well qualified P-4 man to replace Woolfolk, who transferred this January, is assigned at an early date.

Artificial Range Reseeding:

The most urgent job for the season is to make a thoroughgoing analysis of the information now or soon to be available. When this is done, I believe that a publication will be possible. This analysis is also needed to definitely determine where we stand with reference to species adaptation, mixtures, and methods of planting and the next steps to stress.

A special effort was made last fall to collect information needed for a closer analysis of the preparatory crop method. It now appears that poor tools and hastily prepared seedbeds on some old preparatory crop plantings may be responsible for results less promising than after some earlier trials. New and more careful installations may be needed to clear up certain questions as to spring vs. fall plowing, the kind of equipment, etc.

A full schedule of field work is also needed to record and measure results from installations already made. A Ford-Ferguson tractor and spring-tooth harrow were obtained last fall from surplus ERP stock. However, the season was over before necessary overhauling was completed. The cost was about $140. This equipment should be helpful hereafter. A determined effort will be made to get clearance from the Soil Conservation Service or other public agency for a suitable test area of 40-80 acres in northest Montana where we have done no work heretofore but where there is need for reseeding tests.

With a small acreage of several of the more promising new species at Antrim and in Judith Basin, the way is opening up for preliminary testing of the forage value or palatability.

The Assistant Regional Forester in charge of Range Management planned to give special attention to reseeding needs and pilot test plantings on national forest areas. Some time may be required for such work this year, depending conclusions when announced. A memorandum of understanding to guide any such work was signed by the regional forester and director last October.

It is also the plan to condense and revise the rough draft of a guide to reseeding practices which was prepared by Friedrich early in 1945. After the need and scope of this guide for administrative use was questioned by Range Management, the job was set aside pending results of the assistant regional forester's survey of the reseeding job on national forests. It is the plan to revise this to a mimeographed guide as a station research note suitable for farmers and range men. It should also have value for administrative use where reseeding is needed on national forests.

Incidental attention will be devoted to the noxious range weed problem and to the work of state and county control districts and others to control range weed pests. It will be desirable to initiate, as soon as possible, a project to determine how reseeding can contribute to an effective control program. This weed problem becomes worse yearly. Goatweed was found last year for the first time in the Bitterroot Valley and national forest. It has reached serious proportions in western Montana on many thousand acres. Wyethia appears to be spreading on some of the best range on the Beaverhead. There is widespread interest in weed control by newer chemicals and otherwise.

The time is now here to take up full scale the essential "homework" that was of necessity retarded by all out efforts for victory. We must redirect some adequate measure of scientific effort to our ranges and watersheds that are so vital to the welfare of the northern plains and of the nation. A more adequate and factual basis is essential for good stewardship of forage and water resources that have been neglected during the war. We urgently need a well qualified P-4 replacement for range management work. We have two men on military leave in the Pacific to whom we are obligated for jobs at increased salaries. Other costs have increased. We can get by until July, but thereafter we will need more temporary technical help. Men will be available who want jobs. Also we have of necessity gone short on equipment during the war and will also need more of that to reconvert to an adequate effective postwar program of range research. This is needed more urgently than ever to contribute to the stability of existing homes and to the great new developments planned for the Columbia and Missouri River Basins.

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SILVICULTURE

Accomplishments During 1945

The wartime requirements for forest products caused marked changes in the timber situation in the northern Rocky Mountain region. The heavy demand made possible increased use of several less valuable species including grand fir, western hemlock, Douglas-fir, and western larch. Perhaps an even more significant omen of future markets and silviculture was the shipping of considerable quantities of lodgepole pine, spruce, and larch to Wisconsin for manufacture into pulp.

It remains to be proven whether all these new demands will continue, but there are strong indications that they will for "mixed" species lumber, and that for pulpwood, particularly lodgepole pine, markets will increase. The region apparently also is on the threshold of an unprecedented market for lodgepole pine transmission poles.

As a result of the already changed conditions that allow increased marketing of several species, as well as the new developments to be expected from our Forest Utilization Service, many new silvicultural problems have become significant. The program of silvicultural research at this station is therefore being reoriented as rapidly as possible to meet the rush of inquiries concerning the management of the various species that formerly were of only secondary interest to forest managers.

The technical staff of the division was confined to one year-long P-2 Silviculturist, A. E. Helmers; one P-5 Silviculturist, R. K. LeBarron, whose salary was contributed by the Region from June through December; and intermittently employed subprofessional assistants whose time totaled about one man-year.

The regularly scheduled remeasurements of plots and administration of Deception Creek Experimental Forest absorbed the full time of Helmers and the subprofessional assistants. LeBarron devoted his time primarily to getting acquainted with timber management problems throughout the region. Accomplishments, therefore, were limited in character and scope.

Cutting Practices

Wherever possible, advice was given upon the basis of published material, experience, and observations. For instance, suggestions were made concerning tentative cutting practices for lodgepole pine in order to permit proceeding with plans for a sale of 270,000 poles and 30,500 cords of lodgepole pine pulpwood on the Lewis and Clark National Forest, mentioned in the report of our Forest Utilization Service. The suggestions take into account the fact that lodgepole

pine forests usually are situated in watershed areas where regulation of streamflow is of paramount importance to water users. These recommendations, although not final, will serve until more definite conclusions can be obtained.

Timber Stand Improvement

During the war period, while woods labor was being directed to essential activities, the national forests of Region One accumulated substantial deposits of funds allocated to silvicultural betterment of timber sale areas. Questions have been raised as to how these funds can be used most effectively.

The problems of stand improvement measures were discussed and examined briefly on several forests. Some questions had to be left for future study. Others were answered readily. In one instance a set of demonstration plots was established with the assistance of rangers and timber management staff men in a ponderosa pine sale area on the Bitterroot National Forest. The plots shows how the natural tendency for ponderosa pine type to revert to Douglas-fir can be corrected by inexpensive measures. Enough Douglas-fir saplings were felled to liberate young ponderosa pine trees at intervals of 12 feet, which is sufficient pine to insure a good representation of the species in the future stand. A time study made in conjunction with the cutting showed that such work required only 8 hours of labor per acre.

White Pine Blister Rust Control

The station has cooperated with the Office of Blister Rust Control and the regional Division of Timber Management for a good many years. The station's interest in this field has been concerned with defining the most productive white pine areas and with silvicultural operations that might supplement or lighten the enormous task of physically removing or destroying ribes plants. Such silvicultural operations, which have been suggested by members of various organizations, include repeated partial cuttings to induce futile germination of dormant ribes seeds, prescribed broadcast burning of cut-over areas to destroy seeds and bushes, and pruning of infected limbs from young trees.

The techniques for silvicultural operations to aid in the control of blister rust are not yet fully worked out and have some practical limitations that may be difficult to surmount. However, taken together they represent an approach to the problem that has sufficient merit to warrant much additional study.

During 1945, a concerted effort was made by the staffs of the Office of Blister Rust Control, Timber Management, and Division of Silviculture to put across to the men on the ground the need for closer coordination of timber-management activities and blister rust control. The idea of closer coordination in these fields is not new, but the field meetings in 1945 helped to carry it forward. Silvicultural

operations alone are not the total answer to effective control but they can contribute materially.

Remeasurement of Sample Plots

The remeasurement of plots and associated routine work is, of course, not an end in itself but is an essential function of experiment stations. In this particular division it consumed the majority of the available manpower. With a staff of the size needed to meet the silvicultural research job of the region, the sample plot load would not appear so bulky.

Plans for 1946

1. Begin methods-of-cutting, reproduction, and stand improvement studies and undertake detailed examinations of growth and mortality in old cuttings in lodgepole pine type, and expand these activities in ponderosa pine type. This work will be focused as sharply as possible upon providing advice and guidance needed currently in forest management.

Studies of cutting practices in the lodgepole pine type are in the public interest, not only for the sake of assuring continued production of timber, but also because of the importance of this forest type in regulation of streamflow. Silviculture and Forest Influences jointly share the responsibility for determining appropriate cutting methods, each within its own sphere of special skills. Although there is no Forest Influences division in the station at present, provision for such work would be highly desirable. The two divisions working together could most effectively supply the information needed for this phase of region-wide coordination of land use.

2. The older station projects, particularly in the white pine type of northern Idaho, will be given greater attention as the result of the return of P-4 Silviculturist O. A. Wellner from military furlough in January 1946. Considerable data accumulated during the war period is ready for analysis and reporting.

3. Revise and add more recent data to the manuscript on direct seeding that was written shortly after the war started.

4. Prepare a timber stand improvement handbook for the northern Rocky Mountain region. This handbook will replace an earlier one that dealt only with the western white pine type. It has been requested by the Region in connection with planning for possible public works projects. It will also be of immediate use on sale area betterment operations.

The extent to which these projects can be carried forward will depend upon the amount of funds allotted to the division. It should be recognized that certain phases of the studies mentioned under items 1 and 2 are inherently long-time projects that could best be planned and conducted if continuing funds were assured in advance.

FIRE

Accomplishments During 1945

Specific information concerning the highly debatable, multimillion dollar problem of fuel reduction was made available to the Forest Service by Lyman's report "Principles of Fuel Reduction for the Northern Rocky Mountain Region" issued in March 1945. Distribution of this report was limited to typed copies for the Washington office and our Regional Office.

As stated in the Summary and Conclusions: "This report describes guiding principles defining the what, why, and where of economical fuel reduction in the northern Rocky Mountain region. It includes comments on the when and how but does not treat these phases in full." From the analysis of past results of fire control on areas of easy to extremely bad fuel types, the report identifies those situations where more and better manpower, facilities, etc., are likely to be more economical than fuel reduction by controlled burning. However, on the High-High and worse fuels comprising 6 percent of our area, which contributed 55 percent of the burned acreage between 1931 and 1943, purposeful burning to reduce danger is deemed economically justifiable. There are two criteria of such justification, (1) under normal labor conditions when there is no need of employment relief projects, and (2) during bad times when social conditions themselves justify the use of surplus labor devoted to the conservation of resources or other similar projects. Under the first criterion, some 700,000 acres of bad fuels, that are not being remedied by natural decay and growth, are recommended as deserving treatment. Assuming that part of the cost can be charged to social offsetting of depression evils, some 1,600,000 acres of bad fuels could be beneficially treated in this region.

In recommending priorities for the complex variety of conditions involved in fire danger, timber types, soil qualities, accessibility, etc., consideration was given not only to future fire control costs but also to increased timber productivity, to cheaper and more efficient blister rust control, to conversion of poor timber to good range land, to improvement of grazing facility in old burns, to the effects on wildlife, and finally to the overall effect of all of these on the recognized principle that "good forestry means jobs for people, for families, for communities, and for the nation." No credit or debit was given in this study to any possible effects of fuel reduction on streamflow or water supply. This was believed to be altogether too much a matter of opinion in our present stage of ignorance. Believers in either benefits or damages to water supply, who may contend that this feature should have been considered, are referred to the section of this report dealing with Forest Influences.

As is evident from the above, this research concerning fuel reduction was exploratory in character. Its findings are not necessarily conclusive. They are sufficiently supported and sufficiently definite, however, to resolve the previous haze of pure opinion into recommendations usable for the post-war work for which we have been planning. They also constitute specific principles and an outline of basic factors that should be used in plans for both Missouri and Columbia River developments. They deal with conditions at the very source of these great rivers.

Plans for any future work in fuel reduction research are at present entirely unsettled. The outstanding need is stated in the subsection devoted to Fire Research Plans.

With only one technical man remaining on the Fire Research staff, after Lyman left in March 1945, all remaining effort was devoted to current problems in advice and guidance concerning the use by various agencies of our past fire research results. Several of these are significant.

First: Some 200 sets of fuel moisture indicator sticks were leached, recalibrated, and sent to field stations of the Forest Service, Park Service, and Indian Service in April and May. Some dozen or 15 anemometers sent to us by field stations were repaired and then recalibrated in our Missoula wind tunnel. Due to the loss of all personnel previously experienced in such work, the Division Chief had to do most of both of these jobs himself. This situation will persist again in 1946, and until funds and assistants are provided.

Two Canadian requests for sticks also were filled in 1945. Some 25 sets were furnished to the Forest Service in Alberta while one representative of an insurance company in Vancouver, B. C. asked for samples and information. This agent is endeavoring to make his insured loggers more fire-conscious by use of these sticks. He writes: "It may interest you to know that the B. C. Forest Service is adopting for their use, this summer (1946), the same type of sticks that you sent me."

Second: To check and improve the field use of the fire danger measuring system, including the new model 6 meters, Gisborne inspected such work at several stations on each of six North Idaho forests in June 1945. Some radically erroneous practices were found and corrected, but at the majority of stations supervision from the Supervisors' offices and the knowledge of the few remaining field men experienced in such work, was maintaining good consistency of practice. The excellent revision of the Region One Fire Control Handbook, made by the Regional Office in early 1945, had aided greatly. Differences in accuracy and use of fire danger data from forest to forest can still be traced largely to the Supervisor's office.

Neither the States of Idaho or Montana nor any of the State and Private Timber Protective Associations in this region are as yet operating any

fire danger stations. One of the associations does obtain reports from a nearby national forest. Both State Foresters are still content to rate both current fire danger and the character of the past season on the unsupported assertions of their wardens and other assistants.

No changes in our present method of rating fire danger are contemplated for 1946. A new issue of the model 6 meters will be required, however, as the 500 sets made in 1942 and 600 sets made in 1944 have now been completely distributed. Some 50 of these went to the Indian Service, 75 to the Park Service, 200 to Region Four, and the remainder largely to Region One. Quite a few meters also have been distributed on request to the Weather Bureau, to forestry schools, and to individuals throughout the United States and Canada.

Third: At the request of the Regional Office, some time was spent in the office and on one airplane trip into the heart of the "Continental Unit" established to test airplane detection and smokechasing. The nine key lookouts used on this 2½-million acre area were given special instruction in mapping lightning-storm paths and measuring fire danger.

Fourth: Exploratory measurements of the heat content (BTU's per pound) in freshly cut, 10-year-old, and older logging slash indicate that fuel type classification will be more accurate if made on the basis of weight per acre instead of volume. A significant amount of such fuels resist decay in this region for 30 to 40 years following logging and fire. This is a distinctive feature of the fire problem in this region.

Fifth: A manuscript, "Summary of 30 years of weather records at Priest River" was rewritten and is now ready for mimeographing. Publication must be delayed, however, until after July 1, due to lack of funds.

Plans for 1946

Without increased funds, the Division Chief aided by the superintendent of the Priest River Station and by one 3-month assistant will devote his time in 1946 to advancing the following projects of our previous program:

1. Fire control planning

Fuel type classification is one of the basic steps in fire planning as developed by Hornby. Recent exploratory measurements of heat content of fresh, 10-year-old and older logging slash and of fire-killed debris have shown that weight rather than volume of that debris is the more accurate index. Samples will be collected in thinning and pruning plots on logged-off areas and on old burns to commence determining such weights per acre. Bomb calorimeter determinations will be made of the heat content of these samples.

The work done by Lyman on fuel reduction developed a new method of estimating both the economic justification of fuel reduction and a possibility of applying the same method to areas proposed for planting. In the past decisions concerning which areas to plant and which to ignore have been made entirely on the basis of opinion. A write-up of this new method will be developed and distributed for in-Service criticism.

2. Fire danger measurement

At the urgent request of Region Four and to meet the need expressed by several Region One supervisors as well as fire control men from the U. S. Grazing Service, work was started in 1944 on the development of better indicators of grass fire danger. Plots for periodic burning were laid out and burned in 1944 and 1945 on the Nezperce Forest in a grass type typical of the problem confronting all of these agencies. Two new methods of daily measurement of grass fire danger were commenced both at the Riggins Ranger Station and at our Priest River Station. One, called the Humidity Difference Method (difference between humidity at the ground level under grass and at the standard level 4½ feet above ground), shows promise. The other is a test of basswood slats and standard fuel moisture indicator sticks exposed in and under dense grass. Measurements of volume of grass also are obtained by clipping. The Division Chief will continue to participate in some of these burning tests and to check and analyze the data. All of the work on the burning plots is contributed by the Nezperce staff. When assistance is available, burning will be commenced at Priest River.

The "large log study" of moisture content, hence inflammability of heavy fuels, will be continued at Priest River. This work, pioneered by Hayes from 1935 to 1942, is now in its fifth year with four sets of logs 6, 12, and 18 inches in diameter. The logs are weighed at 10-day intervals from May 1 to October 31. This is the only phase being continued of any of the extensive danger measurement research formerly carried on at Priest River. Weights are made by the Priest River superintendent; compilations by the temporary assistant; continual supervision by the Division Chief.

Material is available for preparation of an explanation of number of hours duration of fire danger at different altitudes and on different aspects. This will be summarized and made available to forest dispatchers.

3. Advice and guidance

Inspection of fire danger stations and methods of using these data on the western Montana forests will be made in 1946. These forests have not been visited for this purpose for several years. With the return of war vets and as a result of numerous transfers of fire control

personnel a short school in fire danger measurement and fire dispatching should be held. Such a school will be recommended for the spring of 1947.

Advice concerning danger measurement, mapping of lightning storm paths, visibility as a factor in airplane detection, and other features of the air-control or "Continental Unit" will be continued.

Examination of four plots, 4, 8, 12, and 19 miles from the Anaconda Smelter, established in 1943 at the request of the Regional Office, will be continued in 1946 to determine whether or not damage is accelerating. A simple method of repeated photographs in color is being tested as a substitute for the sulphur dioxide determinations previously made. While SO_2 content of the air is a granted cause of damage, it is sometimes impossible to relate cause and effect. We are photographing the effect. No damage is as yet demonstrable. A similar problem exists around Kellogg, Idaho and needs study.

4. Forest influences

At Priest River we have the only streamflow dam and measurements for a true "Little Waters" in the entire northern Rocky Mountain region. Measurements at this dam and of two recording precipitation gages, of two snow courses, and of the flow of the Benton Spring, are now in their eighth year. All of the field work of weekly change of charts, monthly springflow measurement, and five snow-course cruises each year have been contributed from the time of the Priest River superintendent. Compilation is done by the summer field assistant. The Chief of the Division of Fire Research will continue to give the detailed, periodic supervision required.

5. Cooperation

Records of our measurements of streamflow have been furnished several times at the request of three offices of the Geological Survey. The snow course and springflow reports are submitted to the Soil Conservation Service for publication. Reports from one of the recording gages are published monthly by the Hydrologic Division of the Weather Bureau. Hence this work is in large part mere cooperation. It is also providing us with invaluable data concerning meteorologic, hydrologic, and fire danger conditions for the Benton Creek drainage in its present vegetative cover of 90-year-old timber.

Year-round daily measurements of the weather will be continued in cooperation with the Weather Bureau which publishes monthly and annual summaries. During the fire season, May 1 to October 31, the ordinary "cooperative" measurements are greatly expanded by use of recording instruments, which give us the most complete forest meteorological data for any forest station in the entire northern Rocky Mountain area.

Cooperation with the Kaniksu National Forest is furnished from about June 1 to September 10, first by operation of a fire danger station at our Priest River headquarters, second by supervision of operation of the nearby lookout danger station, and third by special morning assembly of reports and radio transmission to the Kaniksu fire dispatcher. Both the headquarters and lookout station also make special measurements, like other selected forest stations, and report by radio to the Missoula office of the Weather Bureau to aid in localizing the weather forecasts. The routine work along these lines is done by the temporary assistant who is usually a forestry school student or recent graduate. The job is given to a new student each year so that we now have some 16 "graduates" of this training course scattered around the country familiar with our methods and accuracy requirements. This also serves as one method of discovering promising future research workers. Training and supervising this assistant are done by the Division Chief.

Every year considerable time is required of the Division Chief for show-me trips by visiting foresters and others. More time for such work is anticipated in 1946.

If additional funds are made available after July 1, work will be commenced on one or more of the four major fire research projects in the following order of priority. Detailed descriptions of these were submitted in December 1944. (1) An all-out attack on fire control planning principles, which could be completed in 3 years. (2) A follow-up on the Fuel Reduction study of 1944-45 to produce a Manual of Fuel Reduction Practices. (3) A study of the economics of fire control to define specifically what we mean by "adequate fire control at least possible cost." (4) A resumption of the several lines of fire research dropped in 1937 to 1941 and all leading to better fire danger measurement and a soundly based Fire Dispatcher's Guide.

FOREST UTILIZATION SERVICE

On July 1, 1945 the work of our former Division of Forest Products was absorbed by a newly created Forest Utilization Service. This Service is a new step in research aimed at what is now recognized as one of the major opportunities of aiding all industries and communities largely dependent upon forest products. The work of promoting local expansion and improvements in utilization will be done through and with the aid of the U. S. Forest Products Laboratory at Madison, Wisconsin.

In the past the major determinant in the establishment and growth of forest industries has generally been the availability of raw materials in quantities sufficient to maintain the manufacture of a single product, such as lumber, wood pulp, or veneer. Cutting practices under such procedure are narrowly confined to certain species, sizes, and quality, and the rest unused or wasted. The forest area is too frequently viewed with a single end product in mind. Fully developed, well diversified forest utilization, properly integrated with the capacity of the areas to produce timber continuously, should increase income to the landowner, create jobs and a market for forest products, create wealth, enlarge the tax base of the area, and give permanence to the status of the communities having timber resources.

The solution to this problem lies in the field of developing diversified manufacture so as to use in one general locality for various purposes the many species and grades that make up the forest. Utilization must also be complete so that material which is waste or by-products at one plant becomes the raw material of another. The general idea of diversified and integrated utilization has been developed on a partial scale in a few localities, but the whole idea needs stimulation.

Under the new form of organization, I. V. Anderson returned to the station as Division Chief (P-6) on July 1. He was assisted by C. N. Whitney, until the latter's retirement in October, and by J. L. Tinm to date. As Tinm is gradually switching his work into Forest Economics, arrangements have been made for a P-5 specialist in plywood and veneer to report early in March. Until a full Division of Economics is established in our organization, that work as well as all former studies of forest products will be supervised and reported on by the Forest Utilization Service.

Forest Products Statistics

Accomplishments During 1945

The four following projects have been carried for many years at this station. The results are indispensable working tools for the forest products industries and the practicing foresters of the Region.

1. Stumpage Prices

The Bureau of the Census did not provide for the collection of data on private stumpage and log transactions in 1944 because of inadequate funds. Lack of station funds and personnel prevented us from obtaining these data by a field canvass. Hence the continuity of statistics maintained since 1925 was broken. However, records of public transactions were secured and compiled. They showed that public stumpage prices have increased about 35 percent since 1941.

2. Lumber Production

This work is described in the section given to cooperation with other agencies.

3. Sawlog Depletion

Sawlog drain by species and by counties was compiled from lumber production records for Montana, Idaho, and northeastern Washington.

4. Miscellaneous Statistics

The following projects were completed:

a. Christmas tree production in western Montana.
b. Cost of manufacturing lumber for the band sawmills of the region.
c. Average wholesale and retail selling values of lumber during 1945.
d. Railroad tie specification summary revision.

Plans for 1946

Continue all of the statistical studies mentioned above. Resumption of the collection of private stumpage transaction data will be dependent on Bureau of the Census approval and cooperation.

Wood Preservation

Three things stand out in the year's work on wood preservation: viz., (1) a tremendous increase in personal consultation and written advice to individuals interested in going into the business of treating fence posts or power poles for the rural electrification program; (2) a complete revision up to date of wood service tests made in Montana during the past 35 years; and (3) a comprehensive review and re-orientation of wood preservation work and a correlation of it with the Madison Laboratory work program. Service test data on lodgepole pine collected at this station for the past 35 years form the basis for much of its present use and show possibilities for supplying much of the Rural Electrification Program needs of 3 million poles annually.

Using results of tests for lodgepole pine fence posts conducted at this station, small producers of the area are now delivering over 200,000 posts annually. This, of course, is only a small portion of Montana's requirement which is approximately 5 million untreated posts.

Timber Harvesting and Conversion

Cooperation with the Anaconda Copper Mining Company and Timber Structures Inc. in the development of laminated mine skip guides from larch were continued during the year. Observations made during the year indicated a very satisfactory mine guide had been developed. Guides now in use are made from a very select grade of edge grain Coast Douglas-fir. Substitution of larch for this purpose offers an outlet for this species of which a plentiful supply still exists. Present indications are that a laminating plant may be established in Montana to supply mine guide needs as well as local requirements for other laminated products.

Inquiries on the suitability of lodgepole pine for power poles continued throughout the year at an increasing rate. Additional information was developed on size and class of poles available in the different localities of Montana and in the different age classes of the lodgepole pine type. Timm developed new conversion tables that will enable cruisers to determine pole classes by measurement of the tree at breast height. An analysis of the possibilities of establishing a pole industry in Montana indicated a practical ultimate production of a million poles annually on a sustained basis. Present possibilities indicate that it will be practical to bring production up to 500,000 poles yearly in the next 3 years.

Producers of larch and ponderosa pine lumber are interested in production of plywood from a portion of their log supply. Two of the larger sawmill operations have signified a desire to conduct further pilot plant tests of larch as soon as arrangements can be made. Surveys have indicated the practicability of production of 15 million feet of larch plywood annually at each of three different locations in western Montana.

Pulp and Paper

Pulp mills of Wisconsin are looking to Montana with increasing interest as a source of raw material. About 15,000 cords of wood were shipped to Wisconsin at a $10-per-cord freight rate in 1945. During the year arrangements were also made for shipment of two carloads of lodgepole pine 100-inch bolts back to Wisconsin for pilot plant tests. The operator reported yields 25 percent in excess of Wisconsin jack pine and 15 percent better than Minnesota jack pine. As a result, lodgepole pine timber on the Lewis and Clark Forest is being offered for sale at the request of this operator and others. The first unit contains ~~35,000~~ 30,500 cords of pulpwood and 270,000 power poles.

Plans for 1946

It is hoped that transfer of all economics projects to a full Division of Economics will have been completed by the middle of the summer. Until that time, F.U.S. personnel will contribute supervisory time to the lumber production survey for the Bureau of Census. Tentative allotments for this work have already been made and personnel will be available in time to carry on the work.

Some of the Division Chief's time will be devoted to analysis and interpretation of forest products data for the Bonneville Power Administration projects. A tentative commitment has been made for Anderson also to assist in securing the data on plywood desired by that agency.

About 6 weeks of the F.U.S. personnel time will be spent at the Madison Laboratory on training assignments acquainting Anderson with current laboratory work and facilities.

During the first 6 months of the existence of the F.U.S. unit, two members of the staff of the Madison Laboratory were conducted around the Northern Rocky Mountain area to acquaint them with utilization problems in their line as a basis for formulating a program. One of our principal objectives in 1946 will be to get more of the laboratory staff to do this. Sale of the Laboratory's wares will be attempted by bringing selected timber-sales men and possibly a few forest supervisors back to the Laboratory.

F.U.S. personnel will be expected to conduct a continuous inventory of utilization problems that should be referred to the Laboratory for solution. In addition, utilization projects that will be stressed during the year are:

1. Production of plywood from western larch and determination of peeling and slicing (for box material) of spruce, white fir, and as many other species as possible.

2. Determination of pulping properties of different qualities of dead and green lodgepole pine.

3. Analysis of various factors affecting suitability of lodgepole pine for power and telephone poles.

FOREST SURVEY

Personnel.- The Division began the year with two full-time employees and a clerk-stenographer shared with the Division of Forest Products. Zach's transfer in August left only one to carry on the functions until the latter part of November when Metcalf and Brown returned to the staff from the armed forces. The Survey staff increased to four in mid-December with Pissot's return from the army.

Functions, etc.- The function of the Forest Survey to assemble and maintain factual information on the amount and condition of the nation's forest resources is defined by Congressional directive to the Secretary of Agriculture under the McSweeney-McNary Forest Research Act of 1928 and Public Law #321 of the 78th Congress. Although this function had long before been recognized as a federal responsibility, it was first centralized in the Forest Survey branch of Research in this Region in 1932.

Meanwhile the Survey has become the acknowledged authority on forest resources in the region as evidenced by numerous requests for information and resolutions of endorsement by various organizations.

To date approximately 29 million acres has been covered by the Survey at a cost, including regular and emergency funds but excluding W.P.A. funds, of some $615,000. Original cost and maintenance have averaged approximately 2.1 cents per acre for the 14-year period.

Annual allotments during the period ranged from a high of $106,000 to a low of $9,700. The adverse effect of such wide fluctuations in finances from year to year on efficiency and morale are obvious.

Accomplishments During 1945

1945 Reappraisal of the Forest Situation in the U.S.

This project is one of a series of periodic stock-taking investigations by the Forest Service such as were made in 1933 for the Copeland Report and brought up to date in 1938 for the Joint Congressional Committee Report. It was revived again in 1945 to incorporate information available from forest resource studies since 1938 and to determine the impact of the war on forest resources generally.

For the purpose of this study, the nation is divided into twelve regions, each consisting of several or more states or parts of states. The area embracing Idaho, Montana, Wyoming, and the Black Hills' portion of South Dakota is defined as the Northern Rocky Mountain Reappraisal Region. The job of assembling the results of the study in this Reappraisal Region was assigned to Forest Service Region 1. The Region 1 portion of the State of Washington - Pend Oreille, Spokane, Stevens, and Ferry counties - is included in the Pacific Northwest Reappraisal Region.

The basic statistics are summarized by subregion for each of the Reappraisal Regions in a series of 20 tables as follows:

1. Total land area by major use class.
2. Forest land area by operability and availability class.
3. Area of noncommercial forest land by ownership class.
4. Area of commercial forest land by ownership class and stand class.
5. Board-foot volume of commercial saw timber by stand class.
6. Board-foot volume of commercial saw timber by species.
7. Cubic volume of pole timber, tops of saw timber, and useable cull.
8. Cubic volume of saw timber and pole trees.
9. Board-foot volume of saw timber by ownership class.
10. Area of commercial forest land by stand class.
11. Area of virgin timber land by volume condition class.
12. Volume of virgin saw timber by volume condition class.
13. Area of large second-growth timber land by volume condition class.
14. Volume of large second-growth saw timber by volume condition class.
15. Area of small second-growth timber land by volume condition class.
16. Volume of small second-growth saw timber by volume condition class.
17. Area of pole stands by stocking condition class.
18. Area of seedling and sapling stands by stocking condition class.
19. Current annual growth of saw-timber-size trees in board feet and cubic feet, and of pole tree in cubic feet.
20. Average annual drain on the forests by fire, insects, cutting, etc.
__. Summary of logging and primary manufacturing waste.

The Forest Survey Division of the station computed the Region One statistics for tables 1-19, the fire and insect phases of table 20, and summarized these data for the Reappraisal Region. The woods waste statistics were compiled by the Director's office. In addition, the Division contributed the following supplemental phases of the study.

1. The "allowable cut" under sustained yield and "growing stock requirements" under several assumed conditions and objectives.

2. The "extent of increase or decrease in the volume of saw timber in the last 35 years."

3. "An estimate of the area that can be rated fully productive."

4. The trend of annual growth and of deforested areas.

Approximately 75 percent of the Division's time during the year was spent on this project. Although the Reappraisal instructions called for summaries by subregions only, for twenty-six Region 1 counties covered by the Forest Survey the statistics were worked up by counties. This was done in anticipation of detailed requests for information by counties from agencies like the Army Engineers and the Bonneville Power Administration. Also the county level comes closer to the ultimate foundation on which a corrective action program must be built - the locality or logging unit.

No complete revision could be made of forest land ownership. Checks indicated that material changes occurred only in national forest and

county ownership. These ownerships were adjusted respectively from land acquisition reports and from county assessors' reports. Additional adjustments required were made in private ownership except for Stevens and Pend Oreille counties where some Public Domain had since shifted to National Forest.

Adjustment of volumes were made by allowing for reported drain by ownership and species and adjusting for growth. Growth was calculated on the basis of growth percents derived from the original growth surveys.

In addition to work done by personnel of the Forest Survey Division, members of the Division of Forest Products and Utilization and the Director personally spent a total of four man-months also on the Reappraisal Project. Information and statistics on commodity drain, the history of sawmill operation and liquidation, wood waste, forest products production, and the approximate length of life of operation in saw-timber stands of different species and ownerships were compiled and made available for use in writing up various subjects in the section on Other Reappraisal Criteria.

Benewah County Resurvey

The first job undertaken by the newly established Forest Survey Division in 1932 was an inventory of Benewah County, Idaho. Revised results of this study were published in 1937 as Forest Survey Release #8. Revision of the original data consisted in making adjustments for interim (1932-37) reported drain and growth. A second similar revision was made to bring the data to January 1, 1939 for incorporation in the North Idaho report published as Miscellaneous U.S.D.A. Publication No. 508. Such so-called "office revisions" have distinct limitations owing to the difficulty of obtaining complete drain figures and to the difficulty of accurately forecasting growth under the constantly changing stand conditions. For this reason periodic field resurveys are necessary to maintain accurate current inventories. In this region it is planned to make such resurveys at intervals of about 10 years.

Field work of such a resurvey in Benewah County was completed in 1943 and 1944. Board-foot volume and growth computations were completed in 1945 and typed for final processing. The following tabulation shows the trend in growing stock and growth since the latest previous revision.

Other Accomplishments

Comparison of Saw Timber Volume Jan. 1, 1939 and Jan. 1, 1944 by Stand Class and Species

Date	Stand Class	White pine	Ponderosa pine	Western larch	Douglas fir	Other Species	Total
		---- Million board feet, Scribner ----					
1-1-39	Sawtimber stands	258	242	343	249	305	1,396
	Pole stands	73	118	58	142	189	580
	Seedling-Sapling stands	-	-	1	-	5	6
	Total	331	360	432	390	469	1,982
1-1-44	Sawtimber stands	124	239	372	491	502	1,728
	Pole stands	26	5	35	38	50	154
	Seed.-Sap. stands	3	-	2	5	4	14
	Total	153	244	409	534	556	1,896

Comparison of Saw Timber Growth Jan. 1, 1933 and Jan. 1, 1944 by Stand Class and Species

		---- Thousand board feet, Scribner ----					
1-1-33	Sawtimber stands	1,880	570	2,372	1,589	1,336	7,747
	Pole stands	3,304	5,554	3,849	5,862	6,522	24,991
	Seed.-Sap. stands	1	11	5	10	6	33
	Total	5,085	6,135	6,226	7,461	7,864	32,771
1-1-44	Sawtimber stands	3,803	4,032	2,345	3,731	14,306	28,217
	Pole stands	1,668	365	35	805	1,551	4,444
	Seed.-Sap. stands	72	10	22	48	-34 1/	118
	Total	5,563	4,407	2,402	4,584	15,823	32,779

1/ Mortality of grand fir exceeded gross growth by 136 M feet annually, which was only partially offset by growth of other species under this caption.

Other Accomplishments

Requests from various public and private agencies were filled for 345 Survey cover-type maps. Twenty-three miscellaneous requests also were filled for forest resource information requiring considerable computation. Among these were requests from the Army Engineers, Bonneville Power Administration, Western Forestry and Conservation Association, the General Land Office, Forest Supervisors, the Northern Pacific Railway, the American Forestry Association, timber consulting companies, and private timber operators.

A study was made of the correlation of volume and age on some 446,000 acres of uncut white pine saw timber stands in Clearwater. The results raise a question regarding the commonly accepted rotation period of 120 years for this type. The study shows that owing to a high mortality in stands over 100 years, mean annual growth of average unmanaged stands culminates at about 90 years in contrast with 120-130 years for exceptional or normal stands. If this condition is found to prevail generally throughout North Idaho it will have profound significance on the management of the white pine type particularly for private ownership.

Plans for 1946

1. Complete the cubic foot computations for the Benewah County resurvey and issue a report.

2. Revise the manuscript for the western Montana report.

3. Compute statistics required under cooperative arrangements with the Bonneville Power Administration.

4. Revise area and volume statistics by ownership of the Spokane River Drainage for the Army Engineers.

5. Funds and manpower permitting, resurvey Kootenai County, Idaho and Spokane, Stevens, and Pend Oreille counties, Washington.

6. Continue initial surveys in eastern Montana to assemble factual forest resource information in anticipation of requests in connection with the proposed Missouri Valley development.

COOPERATIVE STUDIES

During 1945 the station cooperated with a number of public agencies in a series of studies and surveys aimed at stimulating the production of various materials essential to the successful prosecution of the war and in the reconstruction period to follow. These cooperative studies involved the furnishing of current figures on the production of such critical supplies as forest products, agricultural crops and livestock; analyzing the factors affecting their production; and aiding locally to stimulate and maintain production of these items at an all-time high.

One member of the Utilization Service staff acted as representative for Western Log & Lumber Administrator Brundage during 1945. This man also served as consultant to the Montana Production Agency Committee on Forest Products. All such work was terminated late in 1945.

PRODUCTS SUPPLIES SURVEYS IN COOPERATION WITH THE WAR PRODUCTION BOARD

Accomplishments during 1945

The station continued to cooperate with lumbermen and lumber associations throughout 1945 in furnishing the War Production Board and later the Civilian Production Administration with current figures on lumber and other forest products production, with an analysis of the factors affecting production, and with aid locally in stimulating production. During the first nine months of 1945 the War Production Board was furnished detailed quarterly reports analyzing the production problems within the Idaho-Montana unit and recommending aids and procedures that would ameliorate the adverse conditions and situations. During the last three months of 1945, biweekly statements covering the lumber production situation were required in place of the former quarterly reports.

To supplement "the factors affecting lumber production reports" the Western Pine Association, in cooperation with this office, furnished the War Production Board and the Bureau of the Census with monthly statistics on lumber production and mill stocks on hand separately for six of the western pine producing states.

A direct service to the lumber industry was rendered by this office in the checking, for need and ability to produce for the war effort, all applications for logging equipment and trucks in the Montana unit before final approval by the State s War Production Board and Office

of Defense Transportation. During 1945 some 180 applications were reviewed.

Special reports on the cedar pole and fuelwood production situations in the region were also prepared during 1945.

Until V-J Day a strenuous and almost successful attempt was made by the lumber industry in the region to keep lumber production at the new high war-time requirements despite a continued shortage in both manpower and equipment. Since V-J Day, however, labor strikes and adverse weather conditions have so slowed production that the 1945 lumber cut will be considerably below 1944 figures.

Plans for 1946

Present plans contemplate the preparation for the Civilian Production Administration of monthly reports on the lumber production situation within the region up to July 1946. It is hoped also to continue the cooperative agreement with the Western Pine Association to furnish the monthly statistics on lumber production and mill stocks on hand for the six western pine-producing states. Continuation of these cooperative studies during the last half of 1946 will depend on the allotment of special funds for the purpose.

THE ANNUAL LUMBER PRODUCTION CENSUS IN COOPERATION WITH THE BUREAU OF THE CENSUS

Accomplishments during 1945

A 100-percent canvass of sawmills in the region was made to obtain 1944 lumber production statistics. As a result a total of 672 sawmill reports were collected and edited by the Products Division, 567 from Montana and North Idaho which were sent directly to the Bureau of the Census, and 105 from the four counties of northeastern Washington which were sent to the Pacific Northwest Forest and Range Experiment Station. In addition, 198 reports from South Idaho, obtained and edited by Region Four, were tabulated and forwarded to the Bureau of the Census.

The results of the census were shown by multilithed tables released in November 1945. Montana's total 1944 cut of 448,498 M feet board measure lumber tally was the highest on record, 5.9 percent in excess of 1943. Idaho's total of 910,545 M feet, although not the highest on record, exceeded the 1943 production by 2.3 percent.

Plans for 1946

As soon as final approval is received the station will conduct a similar survey of 1945 lumber production.

FOREST INDUSTRIES AND POWER MARKET STUDIES IN COOPERATION WITH THE BONNEVILLE POWER ADMINISTRATION

In 1944 the Bonneville Power Administration solicited the assistance of the Forest Service in presenting the forest angle of the economic base for determining prospective power markets in the Pacific Northwest. The plans call for an analysis of all counties in Region One west of the Continental Divide. To date reports have been released by B.P.A. for two Region One counties - Flathead and Lake. Reports for Sanders and Ravalli Counties are in process of preparation.

Besides editorial comments and suggestions, the station's function is to provide the following information:

1. Data for a cover type-use map.

2. Statistics on the area of total, commercial and noncommercial forest land by forest type, stand class and ownership class.

3. Estimates of the commercial timber volume by species, stand class and ownership class.

4. Sawlog, lumber and miscellaneous products drain by species and various periods.

5. The name, location and daily capacity of sawmills and other wood-manufacturing plants.

6. An estimate of current forest growth by species.

7. An estimate of the allowable annual cut by species that can be maintained.

The aforementioned reports are intended to serve as a background or general perspective of the relative importance of the various economic factors. Slated for more intensive studies are those factors offering greatest possibilities for further development.

Owing to the paramount importance of forest industries in the economy of some counties and their high importance generally throughout the Pacific Northwest, the BPA is now financing a comprehensive study in this field by the Forest Service. The project is being directed from the Pacific Northwest Station by Ralph Marquis. A transfer of $1500 has been made to this station. Approximately 50 percent of the basic compilation work already has been completed.

While the major objective in this comprehensive inter-regional study is to establish a basis for predicting power markets, it should

incidentally provide a means of exploring more thoroughly than ever before (1) the feasibility of more intensive use of wood products through increased re-manufacturing, (2) the feasibility of diverting currently used forest products to higher uses, such as plywood, and (3) the possibilities of promoting use of wood products now wasted, for pulp, charcoal, chemical derivatives, etc.

Plans for 1946

Continue to supply available information for both the county and the comprehensive report as required, and otherwise assist in promoting these studies.

PRODUCTION GOALS FOR AGRICULTURE IN COOPERATION WITH STATE WAR BOARD FOR MONTANA

As a member of the Technical Advisory Committee, Hartt has given especial attention to range practices and control of noxious weeds. The spread of several of these, particularly goat weed, in western Montana is disturbing. Fertilizer and cropping practices were also reviewed in detail and recommendations made at the State meeting at Bozeman early in June.

FOREST INFLUENCE RESEARCH

Although forests are generally believed to exert a moderating influence on climate, both locally and far to windward, the major significance of manipulating timber, brush, and grass cover in the northern Rocky Mountain region is on streamflow and downstream water supplies. Protection and manipulation of that vegetative cover by careful management is a basic benefit of good forestry, long recognized as one of the principal justifications for Federal ownership of land at the headwaters of our largest rivers. No research work has ever been done in this field by our experiment station although management of some 20 million acres of national forest land at the headwaters of the Missouri and Columbia Rivers is a direct responsibility of the Forest Service.

The problems of watershed management on the east and west sides of the Continental Divide are significantly different in (1) vegetative types, (2) amount of precipitation received, and (3) uses of and dangers from the run-off. On the east side there are some opportunities of influencing run-off through silvicultural methods, as indicated in the Silvicultural Section of this report. The effects of range management, however, are significant on a far larger portion of eastern than of western Montana. Soil erosion and consequent siltation of river channels, storage dams, and irrigation canals are certain to be more significant in the Missouri than in the Columbia River headwaters of North Idaho and western Montana.

While dependable records of precipitation are not available for any of the mountain ranges anywhere in this region, deductions from valley-bottom stations and from mountain snow courses indicate different problems here too. In the Missouri headwaters large portions receive as little as 10 to 13 inches whereas the higher mountains are believed to receive 30 to 35 inches of precipitation in the form of snow alone. The annual amount probably runs as high as 50 inches in spots. Management of vegetative cover to utilize these variable quantities without wasteful loss by evaporation, and to influence both total and seasonal run-off beneficially will require a wide variety of basic data. The objectives of manipulation of vegetation here will be primarily to insure optimum run-off for irrigation use and to reduce siltation of reservoirs and irrigation canals. Flood damage as well as excessive erosion from summer storms are likely to be more important than effects of streamflow on power use or on navigation. Fortunately, any methods of reducing flood crests will naturally contribute to reduced erosion and to a better distribution of water for both power and navigation.

In the western Montana headwaters of the Columbia, however, these priorities may be reversed, with primary emphasis given to water control for power use at the proposed Hungry Horse, and the existent

Kerr, Thompson Falls, and Grand Coulee Dams. Considerable water is diverted for irrigation nevertheless, some 7,376 acres being irrigated even in Flathead County where rainfall is far superior to most of the downstream valley bottoms. Siltation of all dams and reservoirs in these headwaters is also a real problem as evidenced by the present condition of the Thompson Falls dam. The increasing scarcity of irrigation water in this region also is evidenced by a tunnel diversion of Selway River water from Idaho across the summit of the Bitterroots and into the Bitterroot Valley of Montana. Another diversion, of Swan River water across the Mission Range for use on the St. Ignatius Irrigation District, also is being studied.

Under these conditions, even without the urge of the proposed major "Valley Developments", it is obvious that research should be commenced at once to determine (1) the precipitation available, (2) its transport out of the region in the form of streamflow under present vegetative conditions, and (3) how the management of timber, brush, a grass cover can be expected to affect that flow for the future benefit of local communities and industries. While there may be various choices of agencies best able to determine (1) and (2), the problem of how to manage the vegetative cover on forest and range lands for maximum benefits is clearly a job for Forest Research.

DIRECT AND INDIRECT COSTS BY FINANCIAL PROJECTS

F. Y. 1946

Financial Project	Indirect Project Costs (Overhead)	Direct Project Costs	Total Costs
Forest Management	$ 2,015	$ 14,485	$ 16,500
Range Investigations	3,820	27,545	31,365
Forest Products	2,375	17,125	19,500
Forest Resources Investigations	1,180	8,520	9,700
National Forest Protection and Management	365	2,635	3,000
Total	$ 9,755	$ 70,310	$ 80,065

DISTRIBUTION OF DIRECT COSTS BY MAIN PROJECTS

F. Y. 1946

Financial and work project	Cars, main-tenance & new	Scientific equipment, etc.	Travel expenses other than cars	Salaries Regular	Salaries Temp.	Total
FOREST MANAGEMENT						
Silvicultural Invss.	$ 250	$ 603	$ 1,050	$ 5,056	$ 284	$ 7,243
Forest Protection Invss.	225	680	212	6,125	-	7,242
Total	475	1,283	1,262	11,181	284	14,485
RANGE INVESTIGATIONS						
Grazing Management Invss.	300	669	1,215	16,811	450	19,445
Range Reseeding	300	550	500	6,695	55	8,100
Total	600	1,219	1,715	23,506	505	27,545
FOREST PRODUCTS						
Conditioning of Wood	275	825	1,200	5,792	-	8,092
Properties Investigations	500	375	700	4,423	-	5,998
Pulp and Paper	389	-	250	1,739	-	2,378
Chemically Converted Products	100	15	50	492	-	657
Total	1,264	1,215	2,200	12,446	-	17,125
FOREST RESOURCES INVTS.						
Survey	75	78	780	7,587	-	8,520
NATIONAL FOREST PROTECTION AND MANAGEMENT	-	-	208	1,717	710	2,635
Grand Total	$2,414	$3,795	$ 6,165	$56,437	$1,499	$70,310

PERSONNEL OF STATION - January 1, 1946

		Percent of Time on Work Projects
OVERHEAD ADMINISTRATION		
Melvin I. Bradner	Director	
S. Dagmar Nelson	Clerk	
DIVISION OF FOREST PROTECTION		
Harry T. Gisborne	Silviculturist	100%
Albert W. Peiffer	Agricultural Aide	100%
Helen B. Davis	Clerk-Stenographer	60%
DIVISION OF SILVICULTURE		
Russell K. LeBarron	Silviculturist	100%
Charles A. Wellner	Silviculturist	100%
Austin E. Helmers	Silviculturist	100%
Helen B. Davis	Clerk-Stenographer	40%
DIVISION OF RANGE RESEARCH		
Leon C. Hurtt	Range Examiner	Graz. Man. 72%; R. Reseed. 28%
Gordon D. Merrick	Forest Ecologist	Range Reseed. 100%
C. Allen Friedrich	Range Examiner	Range Reseed. 100%
~~Vacant~~	Range Ecologist	Graz. Man. 100%
Roald A. Peterson	Range Examiner	Graz. Man. 100%
Merton J. Reed	Plant Physiologist	Graz. Man. 100%
Eugene R. Hoff	Range Examiner	Graz. Man. 100%
Henrietta A. Flood	Clerk-Stenographer	Graz. Man. 64%; R.Reseed. 36%
DIVISION OF FOREST PRODUCTS		
Irvin V. Anderson	Forester	100%
John L. Timm	Forester	34%; Prod. Supp. 48%; Surveyl8%
Catherine M. Mead	Clerk-Stenographer	45%; Prod. Supp. 9%
DIVISION OF FOREST SURVEY		
Paul D. Kemp	Forest Economist	100%
Clarence W. Brown	Agricultural Aide	100%
Melvin E. Metcalf	Agricultural Aide	100%
Henry J. Pissot	Statistical Clerk	100%
Catherine M. Mead	Clerk-Stenographer	40%
DIVISION OF FOREST BIOLOGY	(In Cooperation with Fish & Wildlife Service)	
_____	Biologist	

FIELD STATIONS

Deception Creek Experimental Forest - Austin E. Helmers
Priest River Experimental Forest - Albert W. Peiffer
Miles City Experimental Range - _____
Vigilante Experimental Range - _____

IN MILITARY SERVICE

Anthony B. Evanko
Grant A. Harris
~~Sergeant S. Romero~~

M. J. PERSHINA

PUBLICATIONS

I. PUBLISHED DURING 1945

A. Departmental Bulletins and Circulars

None

B. Outside Publications

Friedrich, C. Allan
Seeding crested wheatgrass on cheatgrass land. Research Note No. 38. March 1945. Mimeog. (Same article appeared in the Montana Farmer, March 1, 1945 and in the Montana Stockgrower, October 15, 1945.)

Holscher, Clark E.
The effects of clipping bluestem wheatgrass and blue grama at different heights and frequencies. Ecology, Vol. 26, No. 2, April 1945.

Holscher, Clark E.
Controlling the Pricklypear. Montana Stockgrower, October 15, 1945. (Appeared originally in Western Livestock Journal, June 15, 1944.)

Woolfolk, E. J.

1. Important range plants of eastern Montana, buffalograss (Buchloe dactyloides). Montana Stockgrower. January 15, 1945.

2. Important range plants of eastern Montana, needleandthread grass (Stipa comata). Montana Stockgrower, February 15, 1945.

3. Important range plants of eastern Montana, Sandberg bluegrass (Poa secunda). Montana Stockgrower, March 15, 1945.

4. Important range plants of eastern Montana, threadleaf sedge (Carex filifolia). Montana Stockgrower, May 15, 1945.

5. Important range plants of eastern Montana, fringed sagebrush (Artemisia frigida). Montana Stockgrower, June 15, 1945.

Woolfolk, E. J.
Crested wheatgrass gives good returns under heavy grazing. Montana Farmer. April 15, 1945.

Woolfolk, E. J.
Learn to identify this new weed. Montana Farmer. October 15, 1945.

C. Multilithed and Mimeographed Progress Reports

Division of Forest Products
Cost of manufacturing lumber exclusive of interest and discount for Inland Empire sawmills during 1944. (Confidential - not for distribution) Multilithed 1945.

Division of Forest Products
Production of lumber, lath, and shingles in Montana, northeastern Washington, and Idaho, 1944. Multilithed November 1945

Division of Forest Products
Lumber production for the Northern Rocky Mountain region during 1944. Mimeographed December 1945.

Division of Forest Survey
Reappraisal Tables 1-20. (For limited distribution to Forest Service employees engaged on the Reappraisal Project)

Gisborne, H. T.
Critical fire season indicated for 1945 in the Northern Rocky Mountain Region. Research Note No. 36. February 1945. Mimeog.

Tinn, J. L.
Christmas tree production in western Montana in 1944. Research Note No. 37. March 1945. Mimeog.

II. ESTIMATES OF DEPARTMENTAL PRINTING NEEDS

A. Formal Manuscripts to be Submitted for Departmental Publication Prior to June 30, 1946

Hurtt, Leon C.
Management of Northern Great Plains cattle ranges to minimize drought effects. (Revision to editor's office June 11, 1945, in process of or awaiting editing.)

B. Formal Manuscripts to be Submitted for Departmental Publication during Fiscal Year 1947

Holscher, Clark E.
Proper forage utilization key to efficient cattle production of Northern Great Plains. (First draft completed, in process of revision.)

Kemp, Paul D. et al
The forest situation in western Montana. U.S.D.A. Misc. Publication, 50-60 pages, illustrated, 35 charts, 10 pictures.

Schopmeyer, C. S. and Helmers, Austin E.
Seeding as a means of reforestation in the northern Rocky Mountain region. (Reviewed by Washington Office Board of Review 1945. Returned for revision and inclusion of more recent data.)

Woolfolk, E. J.
Managing Northern Great Plains sheep range for sustained maximum production. (In process of revision by author.)

III. ARTICLES AND OTHER MANUSCRIPTS PROPOSED FOR OUTSIDE PUBLICATION DURING CALENDAR YEAR 1946

Hurtt, Leon C.
Noxious weeds on Montana ranges. Montana Farmer and Station Research Note.

LeBarron, Russell K.
The second-growth timber situation in Idaho and Montana. For publication in Proceedings of the Western Forestry and Conservation Association. Paper presented at meeting in Portland, Oregon, December 13, 1945.

Merrick, Gordon D.
Planting blue grama in wheatgrass stands in eastern Montana. Station Research Note (mimeog.), also condensed as technical note for Jour. of Amer. Soc. of Agron.

Merrick, Gordon D. and Friedrich, C. Allan
Seedbed preparation for reseeding Montana range land. Popular article for Montana Farmer.

Peterson, Roald A.
Range cattle habits as influenced by rate of stocking, composition, and topography in eastern Montana. (Probably Jour. of Agron.)

Peterson, Roald A.
Crested wheatgrass competes successfully with saltgrass. (Probably Montana Farmer)

Reed, M. J.
Height-volume relationship of bluestem wheatgrass. (Probably Ecology)

Reed, M. J.
Moderate grazing for sustained yield of forage on northern short-grass ranges. (Probably Montana Farmer)

Reed, M. J. and Peterson, Roald A.
Important range plants in eastern Montana. Montana Stockgrower. (Continuation of series begun by Woolfolk)

January 28, 1946

THIRTY-SIXTH ANNUAL REPORT

FOR FISCAL YEAR 1946

HARVEST CUTTINGS - LODGEPOLE PINE TYPE

FIELD DIVISION: Forest Management Research

WORK PROJECT : Silviculture

LINE PROJECT : Harvest Cuttings (Lodgepole Pine Type)

PURPOSE OF WORK: To develop methods of cutting, soil preparation, and slash disposal that will insure (1) satisfactory regeneration of desirable species, and (2) the largest returns of useful timber products, consistent with regulation of streamflow.

REVIEW OF PAST WORK: Between 1906 and 1915 extensive timber sales for mine products, made by the Forest Service in vicinity of Butte and Anaconda. Studies conducted by Region One at that time, reported in two Department Bulletins (Nos. 154 and 234), indicated desirability a rotation of 140 years, clearcutting over-mature stands, selective cutting generally of the larger trees in mature stands, improvement thinnings in immature stands, and disposal of slash by piling and burning. Recent studies by Rocky Mountain Forest and Range Experiment Station in Colorado indicates that snow accumulation is increased by heavy or clearcutting, but point out desirability of preserving a patchy distribution of timber cover to retard evaporation and spring melting.

ACCOMPLISHMENTS DURING PAST YEAR: Brief reviews of old cuttings and a few new ones, chiefly on Deerlodge and Gallatin National Forests, to become familiar with the timber type and its problems.

PLANS FOR 1946: In cooperation with Division of Timber Management, initiate harvest cutting and regeneration experiments on Lewis and Clark National Forest. Undertake detailed examination of old cuttings on Gallatin and Deerlodge. Detailed study of streamflow aspects will depend upon the establishment and participation of a Division of Forest Influences.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: Russell K. LeBarron.

NOT FOR PUBLICATION